RUST GEOTECH INC.

Spectral Gamma-Ray Borehole
Log Data Report

Borehole 51-06-12

Log Event A

Borehole Information

Farm : TX	**Tank :** TX-106	**Site Number :** 299-W15-158
N-Coord : 41,804	**W-Coord :** 75,850	**TOC Elevation :** 670.00
Water Level, ft :	**Date Drilled :** 4/30/1976	

Casing Record

Type : Steel-welded	Thickness : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 105	

Borehole Notes:
This borehole was drilled to a depth of 105 ft in April 1976. The borehole was apparently completed to a total depth of 100 ft using 6-in. casing. The drilling log is not available for this borehole; however, the log of the K-40 concentrations suggests that the upper 23 ft of the borehole was either grouted or contains an additional casing.

The casing thickness is presumed to be 0.280 in., on the basis of published thickness for schedule-40, 6-in. steel tubing.

The zero reference for the SGLS logs is the top of the borehole casing. The top of the casing is flush with the ground surface.

Equipment Information

Logging System : 1	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 11/1995	**Calibration Reference :** GJPO-HAN-3	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number : 1	**Log Run Date :** 1/30/1996	**Logging Engineer:** Bob Spatz
Start Depth, ft.: 96.5	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 48.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

Log Run Number : 2	**Log Run Date :** 1/30/1996	**Logging Engineer:** Bob Spatz
Start Depth, ft.: 0.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 13.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

Log Run Number : 3	**Log Run Date :** 2/1/1996	**Logging Engineer:** Bob Spatz
Start Depth, ft.: 49.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 12.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

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Analysis Information

Analyst : H.D. Mac Lean

Data Processing Reference : P-GJPO-1787 Analysis Date : 10/6/1996

Analysis Notes :

Logging of this borehole was accomplished by the SGLS in three logging runs. The pre-survey field verification spectra for all three logging runs failed to meet the acceptance criteria established for the peak shape and system efficiency. A nonconformance report issued in August 1996 (N-96-05) identified the cause of this failure as a power supply malfunction that resulted in a low detector bias voltage being supplied to the logging tool. This malfunction occurred in the mornings because the power supply malfunction corrected itself after an abnormally long system warm-up time. The nonconformance report also documents that radionuclide concentrations calculated from data collected in the first 2 hours of logging could be systematically underestimated by about 10 percent. Data from the logging runs are probably unaffected, but there is a possibility that some of the data collected during the early part of the logging runs may show a repeatability problem if the borehole is re-logged in the future.

The post-survey field verification spectra for all logging runs passed the acceptance criteria for the peak shape and system efficiency, indicating that the logging system was operating within specification after an initial warm-up period. The energy calibration and peak-shape calibration from the post-survey field verification spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during logging. There was no gain drift during the logging activity.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

Depth overlaps, where data were collected by separate runs at the same depth, occurred in this borehole between 48 and 49 ft and 12 and 13 ft. The KUT and Cs-137 concentrations were calculated using the separate data sets at the overlapping depth points. The calculated concentrations of these radionuclides were within the statistical uncertainty of the measurements, indicating very good repeatability of results from the logging activity.

Cs-137 was the only man-made gamma-ray-emitting radionuclide detected in this borehole. Cs-137 contamination was detected almost continuously from the ground surface to 13 ft. Detectable quantities were also encountered at 18 ft. Zones of relatively higher Cs-137 contamination were detected at depths of about 2 and 10 ft. The highest measured Cs-137 concentration was 5 pCi/g at 2 ft. Measured concentrations were generally about 1 pCi/g elsewhere in the borehole.

The logs of the naturally occurring radionuclides show that between the ground surface and 23 ft, K-40 concentrations are below the normal concentrations usually detected in the back-fill material that surrounds the tank. Although the drilling log is not available, the data indicate that the upper 23 ft of the borehole was either grouted or contains additional casing. Between 23 and 40 ft, K-40 concentrations remain at normal levels. Both the K-40 and Th-232 concentrations slightly decrease below 40 ft, then increase significantly below about 47.5 ft. K-40 concentrations decrease noticeably below a depth of 93 ft.

The calculated concentration of man-made radionuclides between the ground surface and a depth of approximately 23 ft have not been corrected for the gamma-ray attenuation of the unknown thickness of the grout or surface casing that may exist in this region of the borehole. The calculated K-40 concentrations in this

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region are about half the values normally measured in SGLS logs acquired within the back-filled portion of the tank farm. The intensity of the gamma rays at energies used to calculate the concentration of man-made radionuclides such as Cs-137 could be similarly attenuated; accordingly, the measured concentration of man-made radionuclides appearing on the logs might be 50 percent or less of the actual concentration.

The SGLS total count log plot reflects the log plots of the Cs-137 concentrations where detected and the concentrations of the naturally occurring radionuclides elsewhere. There is a pronounced increase in the SGLS total count rate below a depth of about 47 ft and a decrease in the count rate below a depth of about 81 ft. Slight peaks occur in the SGLS total count-rate activity at depths of about 86 and 92.5 ft.

Details regarding the interpretation of the data for this borehole are presented in the Tank Summary Data Reports for tanks TX-106 and TX-110.

Log Plot Notes:

Separate log plots show the man-made (Cs-137) and the naturally occurring (KUT) radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, in addition to the total gamma derived from the spectral data and the Tank Farm gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.